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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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04/09/2004

Min-Lung Huang

HUAN3261/EM

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EXAMINER

KALAM, ABUL

ART UNIT

PAPER NUMBER

2814

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/820,856	<b>Applicant(s)</b> HUANG, MIN-LUNG	
	<b>Examiner</b> Abul Kalam	<b>Art Unit</b> 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 13 August 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3,4,7,20 and 21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,7,20 and 21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |                                                                                      |                                                                   |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____                                                          | 6) <input type="checkbox"/> Other: _____                          |

## DETAILED ACTION

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 13, 2007, has been entered.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. **Claims 1 and 4** are rejected under 35 U.S.C. 102(b) as being anticipated by **Mis et al. (US 5,767,010; previously cited, hereinafter, Mis)**.

With respect to **claim 1**, **Mis** teaches (**FIGs. 5 and 6**) an under bump metallization structure applicable to be disposed on bonding pads (**24**) of a semiconductor wafer, wherein a passivation layer (**26**) covers the wafer and exposes the bonding pads, the under bump metallization structure comprising:

- an adhesive layer (**28**) formed on the bonding pads (**24**);
- a first barrier layer (**30**) disposed on the adhesive layer (**28**);
- a wetting layer (**32**) formed on the first barrier layer (**30**) (**col. 4: Ins. 11-27**); and

a second barrier layer **(34')** disposed on the wetting layer **(32)** (**col. 5: Ins. 58-67**), wherein a material of the second barrier comprises tin and copper, wherein the tin and copper of the second barrier layer are not fully reacted with each other **(it is implicit that some portion of the copper layer 34 did not fully react with the tin from the solder; col. 5: Ins. 63-65)** and wherein the quantity of the copper is larger than that of tin **(Cu<sub>3</sub>Sn)** (**col. 5: Ins. 58-67**).

With respect to **claim 4**, **Mis** teaches the structure of claim 1, as set forth above, wherein the wetting layer **(32)** is a copper layer (**col. 4: Ins. 21-27; chromium-copper is a copper alloy, and thus is considered a copper layer**).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claim 3** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Mis ('010)**, as applied to claim 1 above, and further in view of **Michael (US 5,563,102; previously cited)**.

With respect to **claim 3**, **Mis** teaches all the limitations of claim, as set forth above in claim 1, with the exception of disclosing: wherein the first barrier layer is a nickel-vanadium layer or a nickel layer.

However, **Mis** teaches that the first barrier layer (**30, FIG. 6**) is formed of chromium (**col. 3: Ins. 11-27**), and **Michael** teaches that a barrier layer may formed of materials such as nickel-vanadium or chromium (**col. 9: Ins. 9-15**).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the structure of Mis with the teaching of Michael, to form the first barrier layer comprising nickel-vanadium, because it would have been considered a mere substitution of art recognized equivalent materials (MPEP 2144.06).

Substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. *In re Fount* 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Lindle Air Products Co.* 85 USPQ 328 (USSC 1950).

3. **Claims 7, 20 and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Mis ('010)** as applied to claim 1 above.

With respect to **claim 7**, **Mis** teaches all the limitations of the claim, as set forth in claim 1 above, with the exception of disclosing: wherein the thickness of the second barrier layer is ranged from about 50µm to 80µm.

However, it has been held that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 105 USPQ 233, 234 (CCPA 1955). Furthermore, where patentability is said to be based upon particular chosen range or dimension recited in a claim, the Applicant must show that the chosen range or

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dimension is critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have a thickness of the second barrier layer in such a range as claimed, because the range is not critical since it can be optimized during routine experimentation, depending upon the conductivity desired for the second barrier layer.

With respect to **claim 20**, **Mis** teaches all the limitations of the claim, as set forth above in claim 1, including wherein the second barrier layer (**34'**, **FIG. 6**) comprises tin and copper. However, Mis does not disclose wherein the tin and copper are present in the second barrier layer at the time of disposing the second barrier layer on the wetting layer. The phrase "at the time of disposing the second barrier layer on the wetting layer," recites a product by process limitation, and thus, is not given patentable weight. Note that a "product by process" claim is directed to the product per se, no matter how actually made. *In re Thorpe et al.*, 227 USPQ 964, (CAFC, 1985) and the related case law cited therein which makes it clear that it is the final product per se which must be determined in a "product by process" claim, and not the patentability of the process, and that, as here, an old or obvious product produced by a new method is not patentable as a product, whether claimed in "product by process" claims or not. As stated in Thorpe:

Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. *In re Brown*, 459 F.2d 531, 535, 173 USPQ 685, 688 (CCPA 1972); *In re Pilkington*, 411 F.2d 1345, 1348, 162 USPQ 145, 147 (CCPA 1969); *Buono v. Yankee Maid Dress Corp.*, 77 F.2d 274, 279, 26 USPQ 57, 61 (2d. Cir. 1935);

**Note that Applicant has burden of proof in such cases** as the above case law makes it clear.

With respect to **claim 20**, **Mis** teaches all the limitations of the claim, as set forth above in claim 1, including further comprising a solder bump (**42, FIG. 6**), wherein the solder bump comprises tin (**col. 5: Ins. 43-45**). Thus, **Mis** teaches all the limitations of the claim with the exception of disclosing, wherein the tin of the second barrier layer is not from the tin of the solder bump. However, such a limitation is not considered critical to the invention. It does not matter if the tin in second barrier layer is from the solder bump, the device would still possess the same utility as Applicant's claimed structure. Furthermore, Applicant has not disclosed that the limitation is for a particular unobvious purpose, produces an unexpected result, or are otherwise critical, and thus, it appears that the device would possess the same utility without such a limitation. Indeed, it has been held that limitations are *prima facie* obvious, absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV)(B).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to form the structure, as claimed, because the limitation is not critical, and the device would possess the same utility without the limitation.

### ***Response to Arguments***

4. Applicant's arguments filed on August 13, 2007, have been fully considered but they are not persuasive.

Applicant argues that the Mis reference fails to disclose a second barrier layer wherein the tin and copper of the second barrier layer are not fully reacted. The argument is not persuasive, because it is implicit that some portion of the copper layer 34 did not react with the reflow of solder (**col. 5: Ins. 63-64**), and thus, the tin and copper are not fully reacted. Furthermore, it is also implicit that the intermetallic region 34' is a phased region in which the composition of the copper and tin is different throughout the layer.

### ***Conclusion***

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Abul Kalam whose telephone number is 571-272-8346.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you



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have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. K./

/Phat X Cao/  
Primary Examiner, Art Unit 2814